AMENDMENTS TO THE CLAIMS

This listing of claims will replace all prior versions and listing of claims in the subject patent application.

List of Claims:

1. (original) A method for operating a cyclone combustor having a first burner and a second burner, each of the first burner and the second burner being in communication with a barrel having a longitudinal axis, a burner end adjacent at least one of the first burner and the second burner, and a throat end opposite the burner end, comprising the steps of:

feeding a stream of a primary fuel and a primary oxidant having a first oxygen concentration into the first burner;

feeding a stream of a secondary fuel and a secondary oxidant having a second oxygen concentration greater than or equal to the first oxygen concentration into the second burner;

combusting at least a portion of the primary fuel with at least a portion of the primary oxidant in the barrel of the cyclone combustor, thereby forming a plurality of primary products of combustion in the barrel of the cyclone combustor; and

combusting at least a portion of the secondary fuel with at least a portion of the secondary oxidant, thereby forming a plurality of secondary products of combustion and a secondary flame, the secondary flame generating a supplemental radiant heat in the barrel of the cyclone combustor.

2. (original) A method as in claim 1, wherein the secondary flame has a longitudinal axis substantially parallel to the longitudinal axis of the barrel of the cyclone combustor.

3. (original) A method as in claim 1, wherein the primary fuel is coal and the secondary fuel is a non-solid fuel.

4. (original) A method as in claim 1, wherein the second burner has a longitudinal axis substantially parallel to the longitudinal axis of the barrel of the cyclone combustor.

5. (original) A method as in claim 4, wherein at least a portion of the second burner is adjacent the first burner.

6. (original) A method as in claim 1, wherein the first oxygen concentration is about 21 vol.% and the second oxygen concentration is greater than about 21 vol.%.

7. (original) A method as in claim 6, wherein the secondary flame has a longitudinal axis substantially parallel to the longitudinal axis of the barrel of the cyclone combustor.

8. (original) A method as in claim 1, wherein the secondary fuel and the secondary oxidant are combusted at a stoichiometric ratio less than 1.0.

9. (original) A method as in claim 8, comprising the further step of:

mixing the plurality of primary products of combustion with the plurality of secondary products of combustion near the throat end of the cyclone combustor, the secondary products of combustion containing a quantity of hydrocarbon radical species that react with the primary products of combustion, thereby acting to lower an amount of nitrogen oxide emissions contained in the primary products of combustion.

10. (currently amended) A method for operating a slagging cyclone combustor in communication with a furnace while minimizing an amount of nitrogen oxide emissions contained in a plurality of primary products of combustion generated during combustion of a coal in the slagging cyclone combustor, the slagging cyclone combustor having a first burner and a second burner, each of the first burner and the second burner being in communication with a barrel having a longitudinal axis, a burner end adjacent at least one of the first burner and the second burner, and a throat end opposite the burner end, comprising the steps of:

feeding a stream of the coal and a primary oxidant having a first oxygen concentration of about 21 vol.% into the first burner;

feeding a stream of a secondary fuel and a secondary oxidant having a second oxygen concentration greater than about 21 vol.% into the second burner, at least a portion of the second burner being adjacent the first burner;

combusting at least a portion of the coal with at least a portion of the primary oxidant in the barrel of the slagging cyclone combustor, thereby forming the plurality of primary products of combustion in the barrel of the slagging cyclone combustor and a stable and continuous flow of a molten slag in the barrel of the slagging cyclone combustor;

combusting at least a portion of the secondary fuel with at least a portion of the secondary oxidant, thereby forming a plurality of secondary products of combustion and a secondary flame, the secondary flame generating a supplemental radiant heat in the barrel of the slagging cyclone combustor and having a longitudinal axis substantially parallel to the longitudinal axis of the barrel of the slagging cyclone combustor, wherein at least a portion of the supplemental radiant heat is transferred to at ~~lest~~ least a portion of the molten slag in the barrel of the slagging cyclone combustor;

mixing the plurality of primary products of combustion with the plurality of secondary products of combustion near the throat end of the slagging cyclone combustor, the plurality of secondary products of combustion containing a quantity of hydrocarbon radical species that react with the plurality of the primary products of combustion, thereby acting to lower the amount of nitrogen oxide emissions contained in the plurality of primary products of combustion, wherein the secondary fuel and the secondary oxidant are combusted at a stoichiometric ratio less than 1.0;

draining at least a portion of the stable and continuous flow of the molten slag from the barrel of the slagging cyclone combustor; and

transferring at least a portion of the plurality of primary products of combustion and at least a portion of the secondary products of combustion from the slagging cyclone combustor to the furnace.

11. (original) A method for extending a range of amenable fuel types and operating parameters of a slagging cyclone combustor having a first burner and a second burner, each of the first burner and the second burner being in communication with a barrel having a longitudinal axis, a burner end adjacent at least one of the first burner and the second burner, and a throat end opposite the burner end, comprising the steps of:

feeding a stream of a primary fuel and a primary oxidant having a first oxygen concentration into the first burner;

feeding a stream of a secondary fuel and a secondary oxidant having a second oxygen concentration greater than or equal to the first oxygen concentration into the second burner;

combusting at least a portion of the primary fuel with at least a portion of the primary oxidant in the barrel of the slagging cyclone combustor, thereby forming a plurality of primary products of combustion and a stable and continuous flow of a molten slag in the barrel of the slagging cyclone combustor; and

combusting at least a portion of the secondary fuel with at least a portion of the secondary oxidant, thereby forming a plurality of secondary products of combustion and a secondary flame, the secondary flame generating a supplemental radiant heat in the barrel of the slagging cyclone combustor.

12. (original) A method as in claim 11, comprising the further step of:

draining at least a portion of the stable and continuous flow of the molten slag from the barrel of the slagging cyclone combustor.

13. (original) A method as in claim 11, wherein the primary fuel is coal.

14. (original) A method for reducing nitrogen oxide emissions from a plurality of products of combustion generated during combustion of a fuel in a cyclone combustor having a first burner and a second burner, each of the first burner and the second burner being in communication with a barrel having a longitudinal axis, a burner end adjacent at least one of the first burner and the second burner, and a throat end opposite the burner end, comprising the steps of:

feeding a stream of a primary fuel and a primary oxidant having a first oxygen concentration into the first burner;

feeding a stream of a secondary fuel and a secondary oxidant having a second oxygen concentration greater than or equal to the first oxygen concentration into the second burner;

combusting at least a portion of the primary fuel with at least a portion of the primary oxidant in the barrel of the cyclone combustor, thereby forming a plurality of primary products of combustion in the barrel of the cyclone combustor;

combusting at least a portion of the secondary fuel with at least a portion of the secondary oxidant at a stoichiometric ratio less than 1.0, thereby forming a plurality of secondary products of combustion and a secondary flame, the secondary flame generating a supplemental radiant heat in the barrel of the cyclone combustor; and

mixing the plurality of primary products of combustion with the plurality of secondary products of combustion near the throat end of the cyclone combustor, the secondary products of combustion containing a quantity of hydrocarbon radical species that react with the primary products of combustion, thereby acting to lower an amount of nitrogen oxide contained in the primary products of combustion.

15. (original) A method as in claim 14, wherein the throat end of the barrel of the cyclone combustor is in fluid communication with a furnace, comprising the further steps of:

transferring at least a portion of the plurality of the primary and secondary products of combustion from the barrel of the cyclone combustor to the furnace;

feeding a stream of an auxiliary fuel into the furnace; and

combusting at least a portion of the auxiliary fuel in the furnace.

16. (original) A method for operating a steam-generating boiler or furnace in communication with a cyclone combustor having a first burner and a second burner, each of the first burner and the second burner being in communication with a barrel having a longitudinal axis, a burner end adjacent at least one of the first burner and the second burner, and a throat end opposite the burner end, comprising the steps of:

feeding a stream of a primary fuel and a primary oxidant having a first oxygen concentration into the first burner;

feeding a stream of a secondary fuel and a secondary oxidant having a second oxygen concentration greater than or equal to the first oxygen concentration into the second burner;

combusting at least a portion of the primary fuel with at least a portion of the primary oxidant in the barrel of the cyclone combustor, thereby generating a first amount of heat in the barrel of the cyclone combustor;

combusting at least a portion of the secondary fuel with at least a portion of the secondary oxidant, thereby generating a second amount of heat and a secondary flame, the secondary flame generating a supplemental radiant heat in the barrel of the cyclone combustor; and

transferring at least a portion of the first and second amounts of heat from the barrel of the cyclone combustor to the steam-generating boiler or furnace.

17. (original) A system for operating a cyclone combustor having a first burner and a second burner, each of the first burner and the second burner being in communication with a barrel having a longitudinal axis, a burner end adjacent at least one of the first burner and the second burner, and a throat end opposite the burner end, comprising:

means for feeding a stream of a primary fuel and a primary oxidant having a first oxygen concentration into the first burner;

means for feeding a stream of a secondary fuel and a secondary oxidant having a second oxygen concentration greater than or equal to the first oxygen concentration into the second burner;

means for combusting at least a portion of the primary fuel with at least a portion of the primary oxidant in the barrel of the cyclone combustor, thereby forming a plurality of primary products of combustion in the barrel of the cyclone combustor; and

means for combusting at least a portion of the secondary fuel with at least a portion of the secondary oxidant, thereby forming a plurality of secondary products of combustion and a secondary flame, the secondary flame generating a supplemental radiant heat in the barrel of the cyclone combustor.

18. (original) A system as in claim 17, wherein the secondary flame has a longitudinal axis substantially parallel to the longitudinal axis of the barrel of the cyclone combustor.

19. (original) A system as in claim 17, wherein the primary fuel is coal and the secondary fuel is a non-solid fuel

20. (original) A system as in claim 17, wherein the second burner has a longitudinal axis substantially parallel to the longitudinal axis of the barrel of the cyclone combustor.

21. (original) A system as in claim 20, wherein at least a portion of the second burner is adjacent the first burner.

22. (original) A system as in claim 17, wherein the first oxygen concentration is about 21 vol.% and the second oxygen concentration is greater than about 21 vol.%.

23. (original) A system as in claim 22, wherein the secondary flame has a longitudinal axis substantially parallel to the longitudinal axis of the barrel of the cyclone combustor.

24. (original) A system as in claim 17, wherein the secondary fuel and the secondary oxidant are combusted at a stoichiometric ratio less than 1.0.

25. (original) A system as in claim 24, further comprising:

means for mixing the plurality of primary products of combustion with the plurality of secondary products of combustion near the throat end of the cyclone combustor, the secondary products of combustion containing a quantity of hydrocarbon radical species that react with the primary products of combustion, thereby acting to lower an amount of nitrogen oxide emissions contained in the primary products of combustion.

26. (currently amended) A system for operating a slagging cyclone combustor in communication with a furnace while minimizing an amount of nitrogen oxide emissions contained in a plurality of primary products of combustion generated during combustion of a coal in the slagging cyclone combustor, the slagging cyclone combustor having a first burner and a second burner, each of the first burner and the second burner being in communication with a barrel having a longitudinal axis, a burner end adjacent at least one of the first burner and the second burner, and a throat end opposite the burner end, comprising:

means for feeding a stream of the coal and a primary oxidant having a first oxygen concentration of about 21 vol.% into the first burner;

means for feeding a stream of a secondary fuel and a secondary oxidant having a second oxygen concentration greater than about 21 vol.% into the second burner, at least a portion of the second burner being adjacent the first burner;

means for combusting at least a portion of the coal with at least a portion of the primary oxidant in the barrel of the slagging cyclone combustor, thereby forming the plurality of primary products of combustion in the barrel of the slagging cyclone combustor and a stable and continuous flow of a molten slag in the barrel of the slagging cyclone combustor;

means for combusting at least a portion of the secondary fuel with at least a portion of the secondary oxidant, thereby forming a plurality of secondary products of combustion and a secondary flame, the secondary flame generating a supplemental radiant heat in the barrel of the slagging cyclone combustor and having a longitudinal axis substantially parallel to the longitudinal axis of the barrel of the slagging cyclone combustor, wherein at least a portion of the supplemental radiant heat is transferred to at ~~lest~~ least a portion of the molten slag in the barrel of the slagging cyclone combustor;

means for mixing the plurality of primary products of combustion with the plurality of secondary products of combustion near the throat end of the slagging cyclone combustor, the plurality of secondary products of combustion containing a quantity of hydrocarbon radical species that react with the plurality of the primary products of combustion, thereby acting to lower the amount of nitrogen oxide emissions contained in the plurality of primary products of combustion, wherein the secondary fuel and the secondary oxidant are combusted at a stoichiometric ratio less than 1.0;

means for draining at least a portion of the stable and continuous flow of the molten slag from the barrel of the slagging cyclone combustor; and

means for transferring at least a portion of the plurality of primary products of combustion and at least a portion of the secondary products of combustion from the slagging cyclone combustor to the furnace.

27. (original) A system for extending a range of amenable fuel types and operating parameters of a slagging cyclone combustor having a first burner and a second burner, each of the first burner and the second burner being in communication with a barrel having a longitudinal axis, a burner end adjacent at least one of the first burner and the second burner, and a throat end opposite the burner end, comprising:

means for feeding a stream of a primary fuel and a primary oxidant having a first oxygen concentration into the first burner;

means for feeding a stream of a secondary fuel and a secondary oxidant having a second oxygen concentration greater than or equal to the first oxygen concentration into the second burner;

means for combusting at least a portion of the primary fuel with at least a portion of the primary oxidant in the barrel of the slagging cyclone combustor, thereby forming a plurality of primary products of combustion and a stable and continuous flow of a molten slag in the barrel of the slagging cyclone combustor; and

means for combusting at least a portion of the secondary fuel with at least a portion of the secondary oxidant, thereby forming a plurality of secondary products of combustion and a secondary flame, the secondary flame generating a supplemental radiant heat in the barrel of the slagging cyclone combustor.

28. (original) A system as in claim 27, further comprising:

means for draining at least a portion of the stable and continuous flow of the molten slag from the barrel of the slagging cyclone combustor.

29. (original) A system as in claim 27, wherein the primary fuel is coal.

30. (original) A system for reducing nitrogen oxide emissions from a plurality of products of combustion generated during combustion of a fuel in a cyclone combustor having a first burner and a second burner, each of the first burner and the second burner being in communication with a barrel having a longitudinal axis, a burner end adjacent at least one of the first burner and the second burner, and a throat end opposite the burner end, comprising:

means for feeding a stream of a primary fuel and a primary oxidant having a first oxygen concentration into the first burner;

means for feeding a stream of a secondary fuel and a secondary oxidant having a second oxygen concentration greater than or equal to the first oxygen concentration into the second burner;

means for combusting at least a portion of the primary fuel with at least a portion of the primary oxidant in the barrel of the cyclone combustor, thereby forming a plurality of primary products of combustion in the barrel of the cyclone combustor;

means for combusting at least a portion of the secondary fuel with at least a portion of the secondary oxidant at a stoichiometric ratio less than 1.0, thereby forming a plurality of secondary products of combustion and a secondary flame, the secondary flame generating a supplemental radiant heat in the barrel of the cyclone combustor; and

means for mixing the plurality of primary products of combustion with the plurality of secondary products of combustion near the throat end of the cyclone combustor, the secondary products of combustion containing a quantity of hydrocarbon radical species that react with the primary products of combustion, thereby acting to lower an amount of nitrogen oxide contained in the primary products of combustion.

31. (original) A system as in claim 30, wherein the throat end of the barrel of the cyclone combustor is in fluid communication with a furnace, further comprising:

means for transferring at least a portion of the plurality of the primary and secondary products of combustion from the barrel of the cyclone combustor to the furnace;

means for feeding a stream of an auxiliary fuel into the furnace; and

means for combusting at least a portion of the auxiliary fuel in the furnace.

32. (original) A system for operating a steam-generating boiler or furnace in communication with a cyclone combustor having a first burner and a second burner, each of the first burner and the second burner being in communication with a barrel having a longitudinal axis, a burner end adjacent at least one of the first burner and the second burner, and a throat end opposite the burner end, comprising:

means for feeding a stream of a primary fuel and a primary oxidant having a first oxygen concentration into the first burner;

means for feeding a stream of a secondary fuel and a secondary oxidant having a second oxygen concentration greater than or equal to the first oxygen concentration into the second burner;

means for combusting at least a portion of the primary fuel with at least a portion of the primary oxidant in the barrel of the cyclone combustor, thereby generating a first amount of heat in the barrel of the cyclone combustor;

means for combusting at least a portion of the secondary fuel with at least a portion of the secondary oxidant, thereby generating a second amount of heat and a secondary flame, the secondary flame generating a supplemental radiant heat in the barrel of the cyclone combustor; and

means for transferring at least a portion of the first and second amounts of heat from the barrel of the cyclone combustor to the steam-generating boiler or furnace.